

WHAT IS CLAIMED IS:

1. An ultrasonic transmitter comprising:

a transducer having a plurality of transducer elements arranged on a surface of the transducer; and

a transmitting beamformer for forming an ultrasonic transmitting beam by driving the multiple transducer elements with a driving pulse signal;

wherein said transmitting beamformer includes a driving pulse signal generator for generating a carrier drive signal through a pulse-duration modulation process and the driving pulse signal while controlling its amplitude and envelope based on the carrier drive signal.

2. The ultrasonic transmitter according to claim 1, wherein the driving pulse signal generator includes:

a control signal generator for generating a rectangular pulse signal of a specific frequency and a control signal for controlling the waveform of a reference signal on which said pulse-duration modulation process is performed; and

a carrier drive signal generator for generating the carrier drive signal by pulse-duration-modulating the reference signal based on the rectangular pulse signal and the control signal.

3. The ultrasonic transmitter according to claim 2, wherein the control signal is a signal made up of binary values 0 and 1.

4. The ultrasonic transmitter according to one of claims 1, 2 and 3, wherein the transmitting beamformer controls directivity of the transmitting beam by varying the amplitude of the driving pulse signal for driving each of the multiple transducer elements based on weight data previously stored in the driving pulse signal generator.

5. The ultrasonic transmitter according to one of claims 1 through 4, wherein the transmitting beamformer varies the amount of time delay introduced into the driving pulse signal for driving each of the multiple transducer elements based on time delay data previously stored in the driving pulse signal generator.

6. The ultrasonic transmitter according to claim 5, wherein the time delay data includes coarse time delay data and precision time delay data, and the transmitting beamformer perform precision delay control operation based on the precision time delay data after performing coarse delay control operation based on the coarse time delay data.

7. The ultrasonic transmitter according to one of claims 1 through 6, wherein the carrier drive signals from which the driving pulse signals to be fed into the individual transducer elements are produced have different frequencies.

8. An ultrasonic transceiver comprising:
the ultrasonic transmitter according to one of claims 1 through 7; and

a receiving beamformer for forming an ultrasonic receiving beam by controlling signals produced from ultrasonic waves received by the multiple transducer elements of the transducer.

9. A sonar apparatus comprising:
the ultrasonic transceiver according to claim 8; and
a device for controlling the receiving beamformer to scan successive sounding directions within the transmitting beam and pick up echo signals from the individual sounding directions and for displaying detected echo data obtained from the echo signals.

10. An ultrasonic transmitter comprising:
a transducer having a plurality of transducer

elements arranged on a surface of the transducer;

a transmitting beamformer for forming an ultrasonic transmitting beam by driving the multiple transducer elements with a driving pulse signal; and

a driving pulse signal generator for generating a carrier drive signal supplied to the transmitting beamformer through a pulse-duration modulation process and the driving pulse signal while controlling its amplitude and envelope based on the carrier drive signal.